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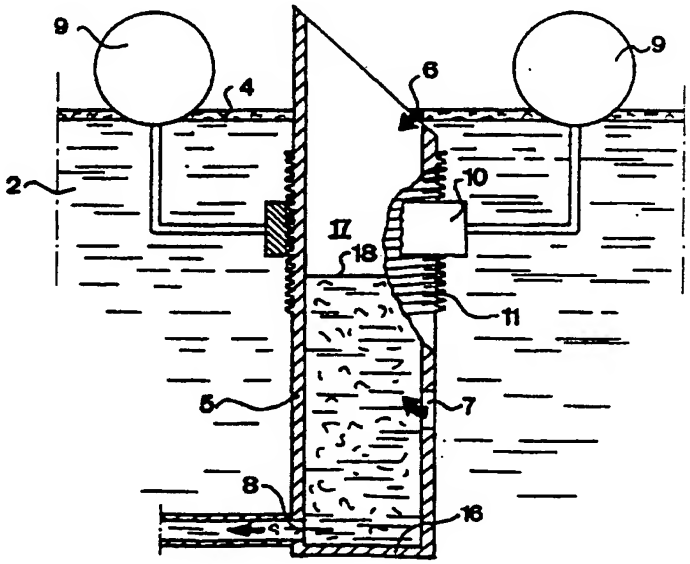
(54) Title: A DEVICE FOR SKIMMING A SURFACE LAYER OF A LIQUID

(57) Abstract

A device is intended to separate a surface layer (4) of a liquid (2) by means of a separating member (5) which is arranged to be kept submerged in the liquid at an operating position. The separating member (5) comprises a first inlet member (6), which in the operating position is located at a first inlet level below the free liquid surface of the surface layer (4) and enables a primary inflow of said surface layer into a space (17) of the separating member, and an outlet member (8), which is arranged to enable an outflow of liquid from said space (17) at level which is positioned below the first inlet member. Furthermore, the separating member (5) comprises a second inlet member (7) which, when the separating member is in said operating position, is provided below the first inlet member (6) and arranged to enable a secondary inflow of liquid to said space (17).



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A device for skimming a surface layer of a liquid

A TECHNICAL FIELD OF THE INVENTION AND PRIOR ART

The present invention refers to a device for skimming a surface layer of a liquid, comprising a separating member, which is arranged to be submerged in the liquid, at an operating position and has a first inlet member, positioned at a first inlet level below the free liquid surface of the surface layer and enabling a primary inflow of said surface layer to a space of the separating member, and which separating member has an outlet member arranged to enable an outflow of liquid from said space at a level positioned below the first inlet member. Moreover, the invention refers to a separating equipment for separating a first relatively light component from a liquid containing at least the first relatively light component and a second relatively heavy component, said equipment comprising a separating member, which is arranged to be submerged in the liquid to an operating position and has a first inlet member, positioned at a first inlet level below a free liquid surface of a surface layer of the liquid, said layer having a high concentration of the relatively light component, and enabling a primary inflow of said surface layer to a space of the separating member, and which separating member has an outlet member arranged to transport a flow of liquid from said space at a level positioned below the first inlet member to a centrifugal separator arranged to separate the first component of this flow from the second component.

In many different situations there is a need of separating relatively lighter liquids from relatively heavier liquids, for instance different liquids used within the industry, such as water, cleaning liquid or cutting liquid, which have to be purified from relatively lighter oil impurities. In these cases the liquid to be purified mostly is contained in

a collection vessel or similar. Thereby, a relatively lighter liquid will float on the surface of the relatively heavier liquid to a large extent. If such oil impurities are allowed to be collected in the collection vessel this may result in health problems due to the aggressiveness of the liquids contained, accumulation and propagation of bacteria, and due to mould formations. In addition, cutting liquids which are not purified are a problem from an environmental as well as economical point of view, since they in this case may not be reused. An other situation in which a need of separation is present may be purification of the sea or a lake from a discharge of oil and the like floating on the surface.

In order to be able to provide such a separation, it is known to use a tubular separator. This is kept submerged in the liquid by means of floating members in such a manner that an upper edge of the separator is positioned immediately below the surface layer of the liquid. Moreover, such a separator comprises a pump member which transports the liquid flowing into the separator over said edge from the lower part of the separator. However, it has been recognized that such separators in practice do not function satisfactorily since they may not be kept in a stable position at the liquid surface. Frequently, this means that the separator will be emptied and thus air will be sucked out through the outlet causing great problems in a subsequent centrifugal separator for the final separation. The problem is due to the fact that if the outflow from the separator is not as large as the inflow thereto the liquid level in the separator will be changed. If, for instance, the outflow from the separator is larger than the inflow the liquid level in the inner space of the separator decreases. This means that the weight of the separator decreases and thus it is lifted to a somewhat higher position in the liquid, leading to a smaller inflow over the edge, and in

this way the separator will displace itself from a position of equilibrium with an accelerated velocity. In the same way, due to a raising liquid level in the separator the latter will sink somewhat in the liquid and thus the inflow increases further and when the liquid level in the separator coincide with the free surface of the surrounding liquid no more inflow of surface to the separator is obtained, i.e. the surface separating effect ceases. Thus, such known separators are unstable. In order to compensate for this unstability it is known to provide flow equalizing vessels. However, such an equipment is expensive as well as space requiring.

EP-A-679 767 discloses such a device for separating a surface layer of a liquid. This device comprises an inlet member at the level of the surface layer and the liquid flowing into the inner space of the device through the inlet member is sucked away by means of a suction device. In order to keep the inlet member at a proper height the device comprises floating members having a lifting force which is controllable by permitting the liquid to flow into the floating members. The inflow of liquid into the floating members is controlled by regulating the pressure in these members by means of pressurized air. However, it is easily recognized that such a control system for continuously adapting the inlet member to a proper height will be very complicated.

SU-A-1 714 040 discloses a surface separator for separating oil being present on the sea surface. Thereby, the separator is submerged in the sea and by means of floating members kept on such a level that an inlet provided in an upper end of the separator will be positioned at essentially the sea surface. The inlet comprises a valve member arranged to open when the separator is at the top of a wave and close when the separator is at the bottom of a wave.

JP-A-6 142 647 discloses a sludge separator having a container connected to a pump for the transport of a sludge from the container. The container comprises a floating piston device having an inlet passage being provided centrally and vertically and through which sludge is sucked to the inner space of the container and from there further to an outlet.

EP-A-389 275 discloses a surface separator for separating a surface layer of a liquid. The separator is partly submerged in the liquid and comprises a chamber through which the liquid may flow and a slightly sloping separating plate provided in the chamber in such a manner that it slopes upwardly in the flow direction of the liquid. Thereby, the surface layer of the liquid will flow upwardly on the separating plate and out through an outlet passage while the rest of the liquid flowing through the chamber flows beside the separating plate below the same.

SUMMARY OF THE INVENTION

The object of the present invention is to remedy the problem mentioned above and provide a device enabling an equal and stable separation of a surface layer. In particular, it is an aim that the outlet of the device in every situation is provided with liquid, i.e. preventing the mixing of air in the liquid separated.

This object is obtained by the device initially defined and characterized by a second inlet member which, when the separating member is in said operating position, is provided below the first inlet member and arranged to enable a secondary inflow of liquid to said space. Such a device is very easy to produce and use. It is not sensitive to variations in the outlet flow and the inlet flow. The liquid

level in the space of a separating member will adjust itself to a position of a equilibrium and this liquid level will be located below the free surface of the surrounding liquid. Thereby, it is ensured that a surface layer of the surrounding liquid is sucked into the liquid separator and if this primary inflow is not as large as the outflow from the separating member the secondary inflow through the second inlet member will in a self-regulating manner compensate therefor so that the liquid level in the space will be at the position of equilibrium. Thus, the second inlet member ensures that the primary flow plus the secondary flow are essentially equal to the outflow. Thereby, the mixing of air in the outflow is also effectively prevented.

According to an embodiment of the invention, the outlet member is arranged to be connected to members for transporting liquid from said space.

According to another embodiment of the invention, the separating member comprises a floating member arranged to keep the separating member in said operating position.

According to a further embodiment of the invention, means are arranged to enable the displacement of the first inlet member in relation to the free liquid surface of the surface layer for the regulation of the primary inflow. Such a possibility of regulation enables control of the mixing relation between the liquid, which via the primary inflow arrives from the surface layer, being enriched of the relatively light component, and the liquid which via the secondary inflow arrives from a layer below this surface layer, in the outflow which, for instance, is supplied to a centrifugal separator connected to the outlet member. Thereby, the concentration of the components of the liquid separated may be adapted to the centrifugal separator in

such a manner that the latter may operate under optimal conditions.

According to a further embodiment of the invention, the second inlet member has an opening area which is adjustable for the regulation of the secondary inflow. This enables adjustment of the reaction velocity of the device, i.e. the velocity by which the separating member compensate for e.g. a variation in the outflow. Thereby, the opening area of the second inlet member may advantageously be automatically adjustable in such a manner that if the liquid level in said space sinks below a predetermined level the opening area increases and if the liquid level rises above this predetermined level the opening area decreases.

According to a further embodiment of the invention, the separating member comprises a container device having an end which opens upwardly and forms the first inlet member. Thereby, the second inlet member may comprise a passage through a wall of the container device. By such a passage the device according to the invention is particularly easy to manufacture.

According to a particular embodiment of the invention the opening area of the second inlet member may be adjustable by means of a valve body provided in the passage of the wall. This may be connected to a floating member, which is provided in the container device and arranged to displace the valve body and thus adjust the opening area when the liquid level in the container device is changed with respect to the predetermined level.

According to a further embodiment of the invention, the first inlet member comprises an edge of the container device, which is adjustable with respect to the free liquid surface in such a manner that said edge is positioned

immediately below the free liquid surface of the surface layer when the separating member is in said operating position.

The object defined above is also obtained by the separating device initially defined and characterized in that the separating device comprises a second inlet member which, when the separating member is in said operating position, is provided below the first inlet member and arranged to enable a secondary inflow of liquid to said space.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be explained more closely by means of different embodiments disclosed by way of example and with reference to the drawings attached.

Fig 1 discloses a side-view of a separating arrangement having a separating device according to the present invention.

Fig 2 discloses a partly sectional side-view of a separating device according to a first embodiment of the invention.

Fig 3 discloses a partly sectional side-view of a separating device according to a second embodiment of the invention.

Fig 4 discloses a partly sectional side-view of a separating device according to the third embodiment of the invention.

Fig 5-8 disclose four different variants of an inlet member of the separating device according to the invention.

DETAILED DESCRIPTION OF DIFFERENT OF EMBODIMENTS

It should be noted that parts and components having a corresponding construction and/or function have been given

the same reference signs in the different embodiments described in the following.

With reference to Fig 1 a vessel 1 or larger container is disclosed which opens upwardly. The vessel 1 contains a liquid 2, which in this example is for instance a cutting liquid for a machine tool 3 schematically disclosed as an example. The machine tool 3 sucks cutting liquid via an outlet conduit from the vessel 1 and recirculates contaminated liquid to the vessel 1 via an outlet conduit. The cutting liquid used and recirculated is contaminated and contains different impurities, at least a part of which is a relatively light impurity, such as a oil product. Since the specific weight of such a light impurity is lower than the specific weight of the cutting liquid 2, these impurities will float up to the surface of the liquid 2 and form a surface layer 4. If the cutting liquid recirculated also contains specifically heavy particles these will sink to and be accumulated at the bottom of the vessel 1. The oil products present in the surface layer 4 are a health problem since, if the surface layer is not removed, accumulations of bacteria and mould are formed. Therefore, a separating member 5 is submerged in the vessel 1 for separating the surface layer 4. The separating member 5 comprises a first inlet member 6, which is positioned at the surface layer 4, a second inlet member 7 and an outlet member 8. Furthermore, the separating member 5 comprises floating bodies 9 keeping the separating member 5 at an appropriate level in the liquid 2, 4. The floating bodies 9 are fixedly provided on an annular holder 10 which has an inner thread which is in engagement with an outer thread 11 of the separating member 5 which in the example disclosed is shaped as a circular cylinder. The separating member 5 is, via the outlet member 8 and an outlet conduit 12 connected to a centrifugal separator 13. The surface layer 4 and the liquid 2 which flow into the separating member 5 via the first and second

inlet members 6 and 7, are thus supplied to the centrifugal separator 13 in which a final separation of the cutting liquid and the impurities is performed. These impurities are discharged through an outlet conduit 14 and the cutting liquid purified is recirculated via a conduit 15.

The construction and the function of a separating member 5 will now be explained more closely with reference to Fig 2. The separating member 5 is shaped as a container which opens upwardly. The first inlet member 6 is formed by the upper edge of the container 5, which is inclined in the example disclosed in Fig 2. The second inlet member 7 is formed by a passage in the wall of the container 5. Thus, the second member 7 is located below the first inlet member 6 when the separating member 5 is in its operating position. The outlet member 8 is formed by a passage extending through the wall of the container 5 and being located in the proximity of the bottom 16 of the container 5. Thus, the container 5 encloses a space 17 receiving liquid 2, 4 flowing inwardly through the first inlet member 6 and the second inlet member 7. The floating bodies 9 are adjusted in such a manner that the first inlet member 6 in a basic adjustment will be located immediately below the free liquid surface of the surface layer 4. Furthermore, the floating bodies 9 are adjusted and provide such a lifting force that this basic adjustment is obtained essentially independent of the amount of liquid in the space 17. The centrifugal separator 13 or a pump provided in the outlet conduit 12 is arranged in such a manner that it will transport the liquid from the space 17 in a relatively constant flow. Advantageously, the basic adjustment frequently is such that a primary inflow of the surface layer 4 and a part of the liquid to therebeneath flows in through the inlet member 6, which primary flow is somewhat less than the outlet flow flowing out through the outlet member 8. Thereby, the liquid level 18 of the liquid present in the space 17 would sink. However, a secondary

inflow through the second inlet member 7 will prevent the liquid level 18 from sinking. The size of the secondary inflow is determined by the height difference between the free liquid surface of the surface layer 4 and the liquid level 18. The pressure difference from the liquid columns of the liquid on both sides of the wall of the container 5 will result in the secondary inflow. This also means that if the liquid level in the space 17 sinks this level difference will be greater and the pressure by which the secondary inflow is influenced increases leading to a greater secondary inflow and thus resulting in the rise of the liquid level 18. In the same way the secondary inflow will decrease if the liquid level 18 rises since the level difference and thus the pressure by which the secondary inflow is influenced will decrease.

In the second embodiment disclosed in Fig 3 the outlet member 8 comprises an outlet conduit 19 extending downwardly into the space 17 and having an orifice in a lower part of the space 17. The outlet conduit 19 is connected to the centrifugal separator 13 in the same way as the outlet conduit 12. Furthermore, this second embodiment comprises an annular member 20 which has an inner thread and which is in engagement with an outer thread 21 of the cylindrical separating member 5. The outer thread 21 is located in the area of the second inlet member 7 and has such a length that the member 20 may be turned in relation to the separating member 5 in such a way that the member 20 covers a variable part of the opening area of the second inlet member 7. In this way the sensitivity of the separating member 5 and by which the secondary inflow compensate for the deviation of the liquid level 18 from a position of equilibrium may be adjusted in advance.

Fig 4 discloses a third embodiment of the invention. In this embodiment the second inlet member 7 is provided as a

passage in the bottom 16 of the separating member 5. In addition, this embodiment has a valve device for automatically regulating the opening area of the secondary inlet member 7 in such a way that if the liquid level 18 sinks under a predetermined level the opening area increases and if the liquid level rises above this predetermined level the opening area decreases. The valve device comprises a conical valve body 22 and a floating element 23. The valve body 22 is mechanically connected to the floating element 23 by means of a bar 24. If the liquid level 18 in the space 17 rises above a predetermined level, corresponding to the length of the bar 24, which length may be adjustable, the floating element 23 will lift the upwardly tapered conical valve body 22 upwardly in such a manner that the opening area of the annular passage of the second inlet member 7 will decrease. If the liquid level 18 in the space 17 sinks below said predetermined level, the valve body 22 will due to its weight be pulled downwardly and thus the opening area of the passage of the second inlet member 7 increases. By this valve device, the secondary inflow may thus be increased in an accelerating manner when the liquid level 18 sinks and be decreased in a corresponding way when the liquid level 18 rises. Thus, the reaction velocity by which the separating member 5 compensates for a deviation from a position of equilibrium will increase.

Since the floating bodies 19 are deliberately adjusted in such a manner that the primary inflow through the first inlet member 6 is smaller than the outflow through the outlet member 8 a continuos secondary inflow through the second inlet member 7 is obtained. In such a manner it is possible to provide a purification of the rest of the liquid 2 present in the vessel 1 in the same time as the surface layer is separated since a part of this rest also is supplied to the centrifugal separator 13. Furthermore, this enables, if the surface layer 4 having the impurities is

very thick, for example, to increase the secondary inflow in order to influence the mixing relation in the liquid supplied to the centrifugal separator 13 in such a way that this may operate under optimal conditions. Furthermore, it is possible to adapt the mixing relation in such a manner that a purification of either the liquid 2 or lighter liquid component in the surface layer 4 may be performed in an optimal manner in the centrifugal separator 13.

The first inlet member 6 may, as is disclosed in Fig 5-8, be shaped in many different ways. In Fig 1-5 the first inlet member 6 is formed by the separating member 5 being obliqually cut. Thereby, the width of the first inlet member 6 increases when the separating member 5 sinks in relation to the free liquid surface of the surface layer 4. The first inlet member 6 may also in a simple embodiment be formed by an edge perpendicularly cut, as is disclosed in Fig 6. By such an edge a maximal length of the first inlet member 6 is obtained which enables the greatest possible inflow of the surface layer 4. However, such an inlet member is very sensitive, i.e. a small deviation from a position of equilibrium rapidly results in a great change of the primary inflow. According to the embodiment disclosed in Fig 7 the first inlet member 6 comprises a plurality of slotted recesses 25 provided in the wall of the separating member 5. Depending on the length i.e. how far below the surface layer 4 these recesses extend, the quantity of the liquid of the surface layer 4 and of the liquid 2, being present immediately below the surface layer 4, to be contained in the primary inflow is determined. Fig 8 discloses a recess 28 provided in the wall of the separating member 5 and tapering downwardly. Such a recess 26 will function in essentially the same manner as the inclined edge disclosed in Fig 1-5. It should be noted that the edge disclosed in Fig 5-8 and forming the inlet member may be displaceable in a vertical direction in relation to the separating member 5

as an alternative or complement to the adjustability of the floating bodies 9.

It should be noted that the thickness of the surface layer 4 merely is schematically disclosed. The surface layer 4 may in certain applications be very thick and for instance extend downwardly below the first inlet member 6. In other applications the surface layer 4 may be a thin film on the surface of the liquid 2 or accumulations of impurities floating on the surface.

The invention is not limited to the embodiments disclosed but may be varied and modified within the scope of following claims. For instance, the container of the separating member 5 may have another than a circular cylindrical shape, it may e.g. be square or rectangular in a cross-section. The floating bodies 9 may be attached to the separating member 5 in many different ways. For instance, they may by means of a holder be fixedly provided onto the separating member 5 and each of the floating bodies may be displaced on its respective holder. Furthermore, the valve device disclosed in Fig 4 may be shaped in many different ways. For instance, it may comprise an inner cylinder which is raised and lowered in relation to a passage provided in a side wall of the separating member 5. Furthermore, it should be noted that a filter may be provided around the separating member 5 and in particular outside the first inlet member 6 and the second inlet member 7 in order to prevent larger particles, fibres and for instance mould accumulations from being sucked into the separating member 5.

It should also be noted that the separating device according to the invention is applicable for purifying many different types of liquids. The mere requirement is that the liquid components to be purified should have specific weight which deviates from the specific weight of the component

contaminated and that the relatively lighter component thus will float on the surface of the relatively heavier component. Beside purifying cutting liquid the separating device according to the invention may thus be used to separate oil products and other greases from water and cleaning liquid within the industry. This is of special interest for the modern cleaning liquids which nowadays are used within the industry and in which oil impurities rises to the surface. Furthermore, the separating device may be used when collecting oil from the sea, lakes and other pools of water.

Claims

1. A device for skimming a surface layer (4) of a liquid (2), comprising a separating member (5), which is arranged to be submerged in the liquid (2, 4) at an operating position and has a first inlet member (6), positioned at a first inlet level below the free liquid surface of the surface layer (4) and enabling a primary inflow of said surface layer to a space (17) of the separating member (5), and which separating member (5) has an outlet member (8) arranged to enable an outflow of liquid from said space (17) at a level positioned below the first inlet member (6), characterized by a second inlet member (7) which, when the separating member is in said operating position, is provided below the first inlet member (6) and arranged to enable a secondary inflow of liquid to said space (17).

2. A device according to claim 1, characterized in that the outlet member (8) is arranged to be connected to members (12, 13) for transporting liquid from said space (17).

3. A device according to any one of claims 1 and 2, characterized in that the separating member (5) comprises a floating member (9, 10) arranged to keep the separating member in said operating position.

4. A device according to any one of the preceding claims, characterized by means arranged to enable the displacement of the first inlet member (6) in relation to the free liquid surface of the surface layer (4) for the regulation of the primary inflow.

5. A device according to any one of the preceding claims, characterized in that the second inlet member (7) has an opening area which is adjustable for the regulation of the secondary inflow.

6. A device according to claim 5, characterized in that the opening area of the second inlet member (7) is automatically adjustable in such a manner that if the liquid level (18) in said space (17) sinks below a predetermined level the opening area increases and if the liquid level (18) rises above this predetermined level the opening area decreases.

7. A device according to any one of the preceding claims, characterized in that the separating member (5) comprises a container device having an end which opens upwardly and forms the first inlet member (6).

8. A device according to claim 7, characterized in that the second inlet member (7) comprises a passage through a wall of the container device (5).

9. A device according to claims 6 and 8, characterized in that the opening area of the second inlet member (7) is adjustable by means of a valve body (20, 22) provided in the passage of the wall.

10. A device according to claim 9, characterized in that the valve body (22) is connected to a floating element (23), which is arranged to displace the valve body (22), and thus adjust the opening area, when the liquid level (18) in the container device (5) is changed with respect to the predetermined level.

11. A device according to any one of the claims 7 to 10, characterized in that the first inlet member (6) comprises an edge of the container device (5), which is adjustable with respect to the free liquid surface in such a manner that said edge is positioned immediately below the free

liquid surface of the surface layer (4) when the separating member (5) is in said operating position.

12. A separating equipment for separating a first relatively light component (4) from a liquid containing at least the first relatively light component (4) and a second relatively heavy component (2), said equipment comprising a separating member (5), which is arranged to be submerged in the liquid to an operating position and has a first inlet member (6), positioned at a first inlet level below a free liquid surface of a surface layer (4) of the liquid, said layer having a high concentration of the relatively light component, and enabling a primary inflow of said surface layer to a space (17) of the separating member, and which separating member (5) has an outlet member (8) arranged to transport a flow of liquid from said space (17) at a level positioned below the first inlet member to a centrifugal separator (13) arranged to separate the first component of this flow from the second component, characterized in that the separating device (5) comprises a second inlet member (7) which, when the separating member is in said operating position, is provided below the first inlet member (6) and arranged to enable a secondary inflow of liquid to said space (17).

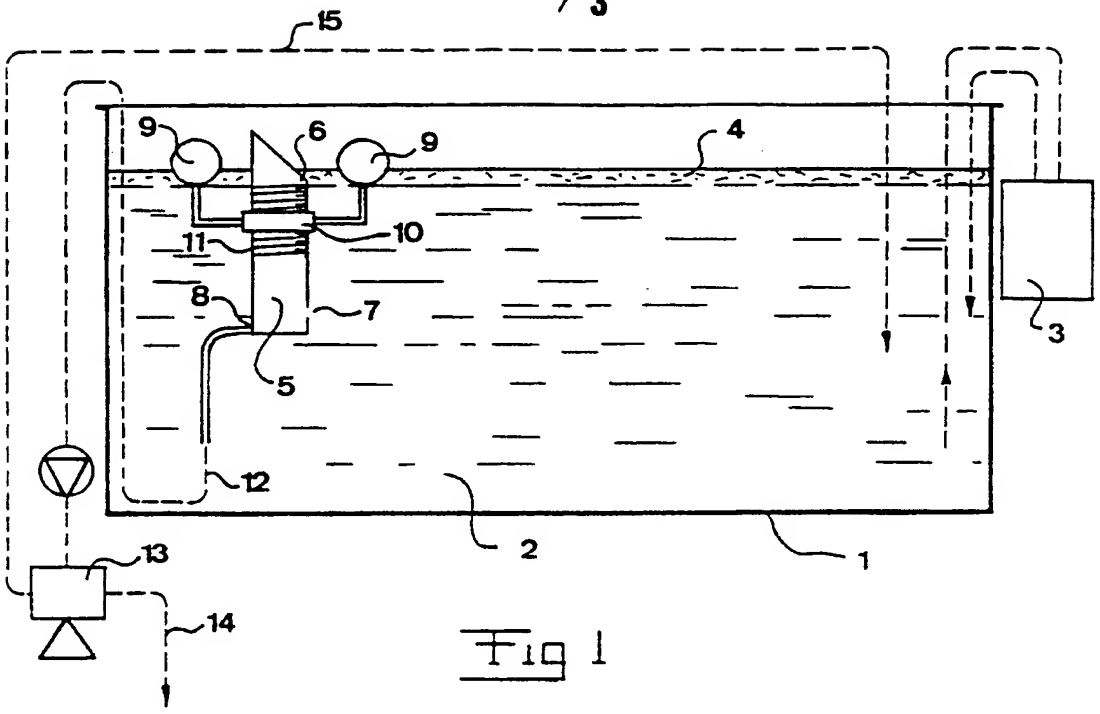

Fig 1

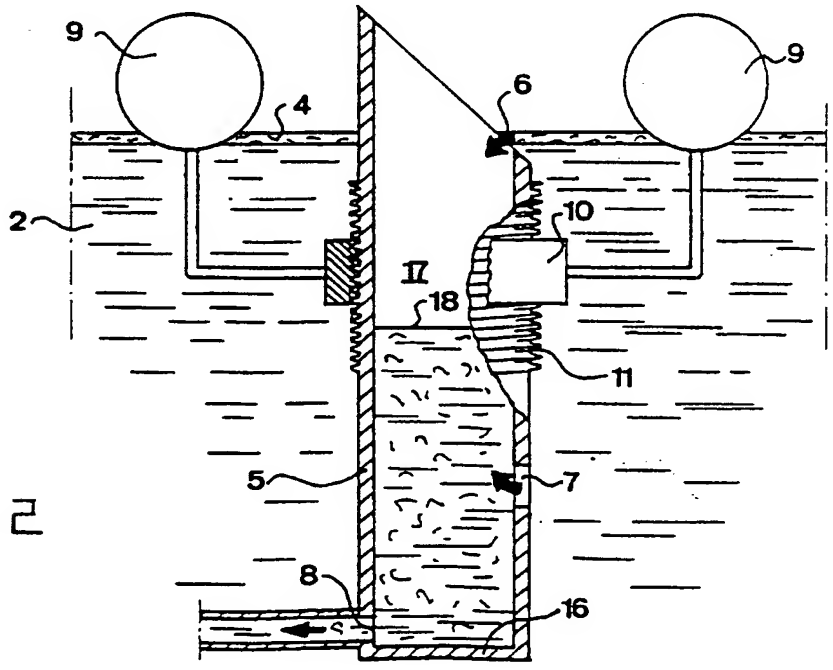

Fig 2

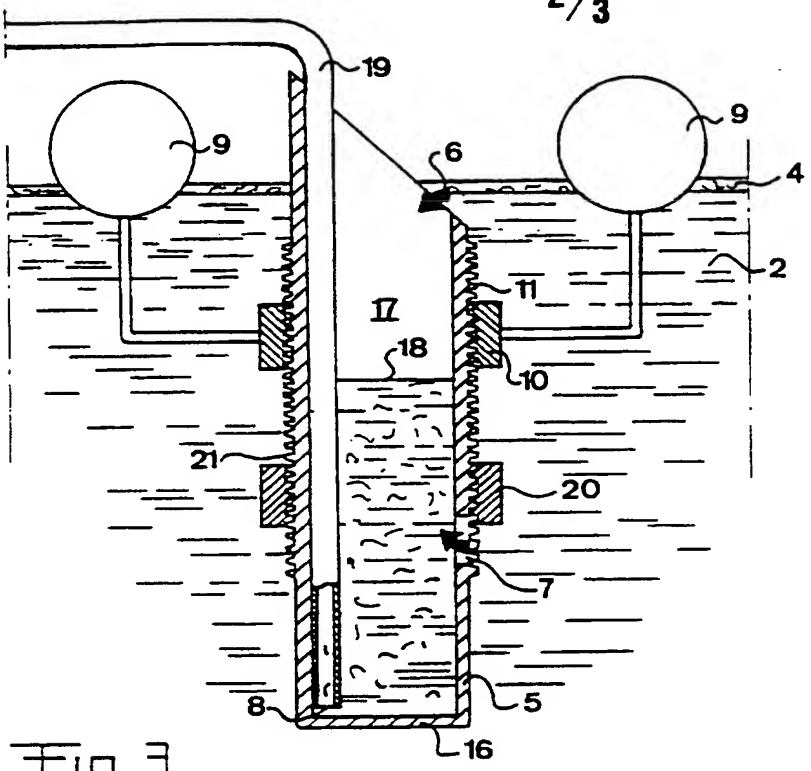

Fig 3

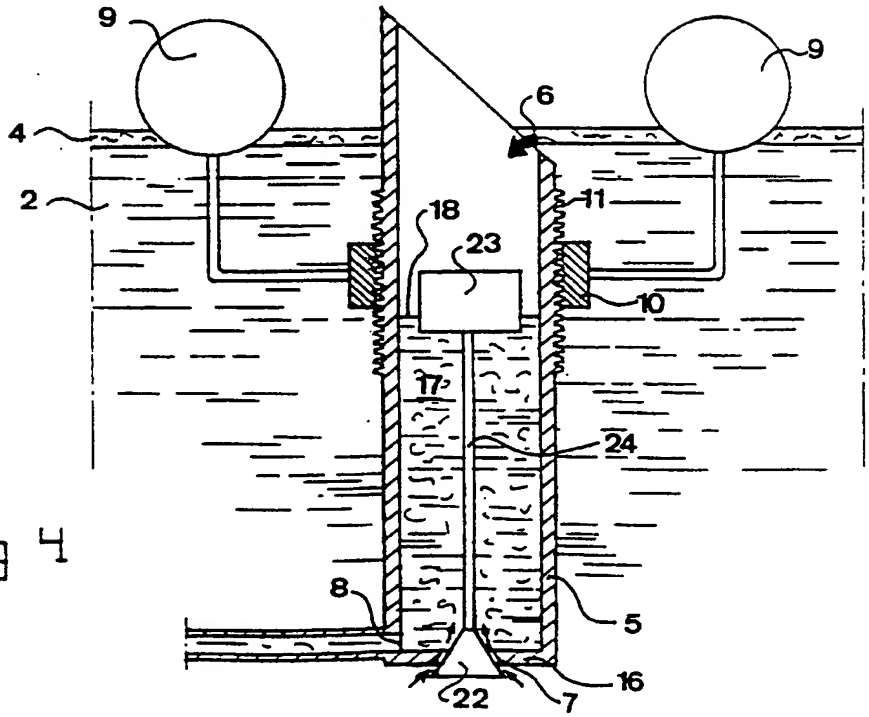

Fig 4

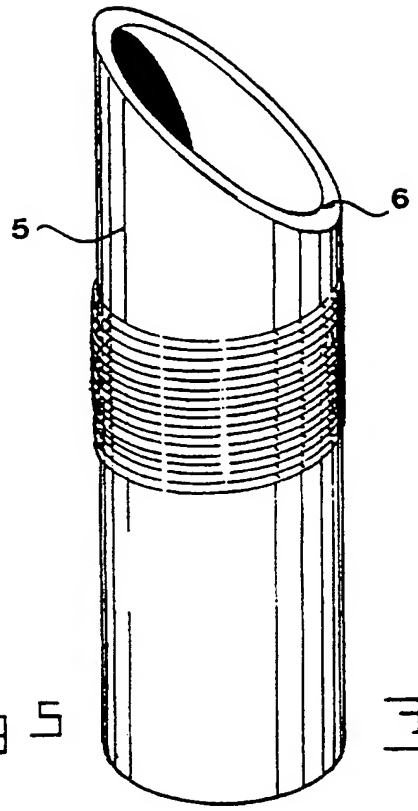

Fig 5

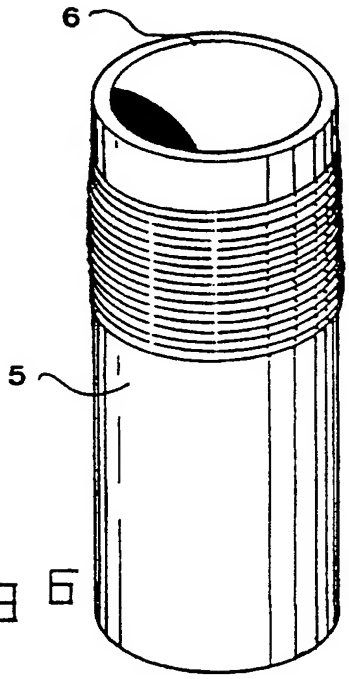

Fig 6

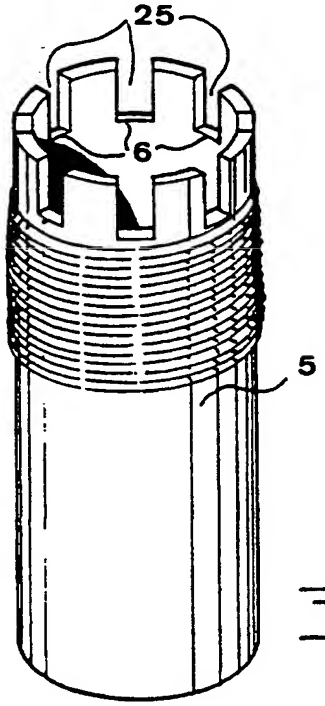

Fig 7

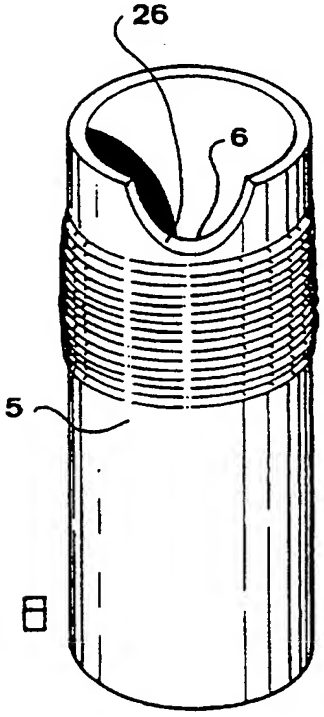

Fig 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00249

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E02B 15/04, C02F 1/40
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: E02B, C02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CH 680342 A5 (WAGNER UMWELTSCHUTZ AG), 14 August 1992 (14.08.92) --	1-12
A	EP 0389275 A1 (ESSOP, SALEAM), 26 Sept 1990 (26.09.90) --	1-12
A	EP 0679767 A1 (JPM INGENIEURTECHNIK GMBH), 2 November 1995 (02.11.95) --	1-12
A	US 4956100 A (K.A. MIKKLESON), 11 Sept 1990 (11.09.90) --	1-12

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 May 1997	16 -06- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Åke Olofsson Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00249

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Derwent's abstract, No 93- 16434/02, week 9302, ABSTRACT OF SU, 1714040 (GIPROMORNEFTEGAZ DES INST), 23 February 1992 (23.02.92) --	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

20/05/97

International application No.
PCT/SE 97/00249

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CH 680342 A5	14/08/92	DE 4033112 A	23/05/91
		DE 9014457 U	20/12/90
		SE 9003351 A	22/05/91
EP 0389275 A1	26/09/90	NONE	
EP 0679767 A1	02/11/95	DE 9406918 U	30/06/94
US 4956100 A	11/09/90	SE 504615 C	17/03/97
		SE 9002048 A	14/12/90